2006

2006

UNDERGRADUATE RESEARCH at SIUC 2006

Published annually by the Office of Research Development and Administration as part of REACH (Research-Enriched Academic Challenge), the undergraduate research program at Southern Illinois University Carbondale. Visit www.siu.edu/~reach.

INSIDE

Southern Illinois University Carbondale

Students from Southern capture awards at St. Louis Area Undergraduate Research Symposium

Three students from Southern Illinois University Carbondale took home cash prizes for research presented at the first-ever St. Louis Area Undergraduate Research Symposium (StLAURS), held April 22, 2006, at Washington University Medical School's Eric P. Newman Education Center.

Sara Reardon, a junior in microbiology from Springfield, Ill., took second place and $250 for an oral presentation examining **genetic links to infertility and cancer.** Raoul Ouedraogo, a senior in electrical engineering from Burkina Faso, won third place and $150 for a poster presentation examining a **novel type of antenna.** Ryan Jones, a junior in physiology from Blue Mound, Ill., received an honorable mention and $75 for his poster on **nerve cells and glucose use.**

"From many perspectives, research is the highest form of teaching and learning, where the student and faculty member experiment, problem-solve, and learn together," said SIUC Vice Chancellor for Research and Graduate Dean John A. Koropchak.

"For this reason, we have for several years been enhancing our opportunities for undergraduates to get involved in research.

"The fact that three of 10 awards went to SIUC students, the only ones to go to students from a public university, is a great testament to the students and their faculty mentors, and to the enriched quality of experience

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With physiology professor Michael Collard, Sara Reardon has been studying DNA structural changes that can lead to cancer and infertility in offspring.

National Science Foundation funds summer undergraduate research program in materials science

Communication problems can get in the way in the research laboratory when people from different fields work together on a project. A newly funded undergraduate research program at SIUC targets that problem while bringing more top students to the University to pursue graduate studies in science.

The National Science Foundation recently awarded SIUC a three-year, $228,000 grant to set up a Research Experiences for Undergraduates program here. The University is chipping in $50,000 to the effort, bringing the total for the project to about $278,000.

For three summers, SIUC will bring to campus 10 undergraduate chemistry, physics, and engineering students—from institutions that offer few undergraduate research opportunities and from groups traditionally underrepresented in those fields—for a **10-week program working on materials research in a laboratory setting.** The program encourages students to choose careers in science and engineering by providing a nurturing environment in which to learn basic research tools and improve oral and written communication skills. The first group of students completed the program this past summer.

Students work with scientists from a variety of disciplines—similar to the arrangement researchers encounter in the field, where they often are part of a team. Daniel Dyer, associate professor of chemistry and biochemistry in the College of Science, says this unique approach helped secure the funding.

"We all have different languages," Dyer says, explaining, for example, that physicists and chemists describe some properties using exactly opposite terms. "Chemistry people have a fundamentally different thought process than, say, engineers or physicists. Not superior, just different.

"Part of this experience is to get the students

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Shelton Matthews (left), an REU student from Grambling State University, worked in summer 2006 with SIUC chemistry professor Punit Kohli (right) on making nanosized hollow "cells" to carry medication for targeted drug delivery. Here they review research data on the structures.

TWENTY UNDERGRADS WIN REACH AWARDS FOR 2006-07

What is REACH?

REACH (Research-Enriched Academic Challenge) is SIUC's undergraduate research program.

Each year, REACH awards 20 grants of $1,500, along with undergraduate assistantships of 10 hours per week, to students proposing a specific research, scholarly, or creative-arts project under the guidance of a faculty mentor. Awards are made on a competitive basis.

REACH also sponsors an annual Undergraduate Research Forum at which students from all disciplines present posters detailing their research.

See page 8 for application deadlines for REACH awards and the forum. See **www.siu.edu/~reach** for more information, including links to other research funding opportunities.

REACH is funded by the Office of the Provost and by the Office of Research Development and Administration, which coordinates it.

Students from seven of SIUC's colleges—from agriculture to liberal arts, mass communication to science—were winners of REACH Awards for 2006-07.

Awards enable students to set up and run independent yearlong research, scholarly, or creative-arts projects with support from faculty mentors. The awards include undergraduate assistantships and small grants to pay for materials and services. The winners and their proposed projects:

Janie Blanks, a senior in civil engineering, will study the operation of multi-reservoir systems using a genetic algorithm. Mentor: John Nicklow (civil engineering).

Brittny Corrigan, a sophomore in zoology, will examine the effectiveness of stimulating the vagus nerve as a means of improving the memory and recovery of head-injured rats. Mentor: Douglas Smith (psychology).

David Dalzotto, a senior in forestry, will attempt to determine the environmental factors influencing the success of current and future efforts to restore giant canebrakes in Southern Illinois. Mentor: Sara Baer (plant biology).

Esteban del Valle, a senior in art with a specialization in painting, will use mixed media and large-scale portraiture to depict coming of age in Chicago. Mentor: Najjar Abdul-Musawwir (art).

TeSha Dozier, a sophomore in psychology, will examine the relationship between body preference and psychological well-being among African-American women. Mentor: Ellen Teng (psychology).

Sean Goodin, a freshman in physiology, will compare the metabolic effects of a melanocortin antagonist in female and male rats. Mentor: April Strader (physiology).

Nadia Lopez, a senior in zoology, will examine enrichment programs aimed at marmosets and tamarins (small Central and South American monkeys) in three different zoos. Mentor: Susan Ford (anthropology).

Amanda Lynch, a sophomore in art, will research the evolution of glass art and glass artists. Mentor: Jiyong Lee (art).

Ryan McMillen, a junior in plant biology, will analyze the diversity of stomata in non-seed plants to see if there is a correlation between structure and genome size. Mentor: Karen Renzaglia (plant biology).

Jeremy Pierce, a junior in psychology, will investigate the effectiveness of a particular substance in treating head-injured rats. Mentor: Michael Hoane (psychology).

Robyn Reeves, a junior in cinema and photography, will explore how to use media to shape community-based learning. Mentor: Cory Byers (radio-television).

Djamilatou Saido Hangadoumbo, a junior in microbiology, will study the intrinsic bioremediation of perchlorate, an industrial pollutant. Mentor: Laurie Achenbach (microbiology).

Kurt Seifert, a senior in biological sciences, will use field work and computer analysis to determine daily autumn migration and predation rates of midges living in a wildlife pond. Mentor: Frank Wilhelm (zoology).

Erin Shanle, a junior in plant biology and chemistry, will research the production of an anti-cancer precursor compound in a particular type of moss. Mentor: Aldwin Anterola (plant biology).

Kelly Smith, a junior in information management systems, will examine ethics requirements and instructional methods in IT and accounting disciplines. Mentors: Diane Davis and Belle Woodward (info. management systems).

Brett Timmons, a senior in zoology, will explore the possibility of using native sunfish to control snail populations. Mentor: Anita Kelly (zoology).

Laura Tolar, a junior in psychology, will examine parent-child interactions and child externalizing behaviors. Mentor: Lisabeth DiLalla (psychology/behavioral and social sciences).

Jodi Vandermyde, a sophomore in zoology, will try to determine if a substance in the sensory organs of fish tells as much about the animal's nutritional levels and environment as it does when it's in muscle. Mentor: Gregory Whitledge (zoology).

April Vigardt, a junior in plant, soil, and agricultural systems, will study how compost made by worms affects the growth and establishment of broccoli transplants. Mentor: Jorge Hernandez (plant, soil, and ag. systems).

Brenda Wright Sanders, a senior in university studies, will try to determine if the medical model of teaching could be used to better prepare school principals. Mentor: John Haller Jr. (history/President's Office).

—K. C. Jaehnig, SIUC Media & Communication Resources

What are undergraduate assistantships?

SIUC's **Undergraduate Assistantship Program** allows students to earn a salary by gaining paraprofessional experience related to their discipline or their planned career. A high percentage of assistantships, which are for 10, 15, or 20 hours per week, involve doing research with faculty mentors.

The feature article on page 4 highlights just one such research project under the aegis of this program. Students may visit **www.siu.edu/~fao** for listings of open positions.

Undergraduate research: what's it all about?

This is the first issue of *Undergraduate Research at SIUC,* which we hope to publish annually. Its purpose is to spotlight one of SIUC's best-kept secrets: the activities and accomplishments of undergraduate researchers and their faculty mentors campuswide.

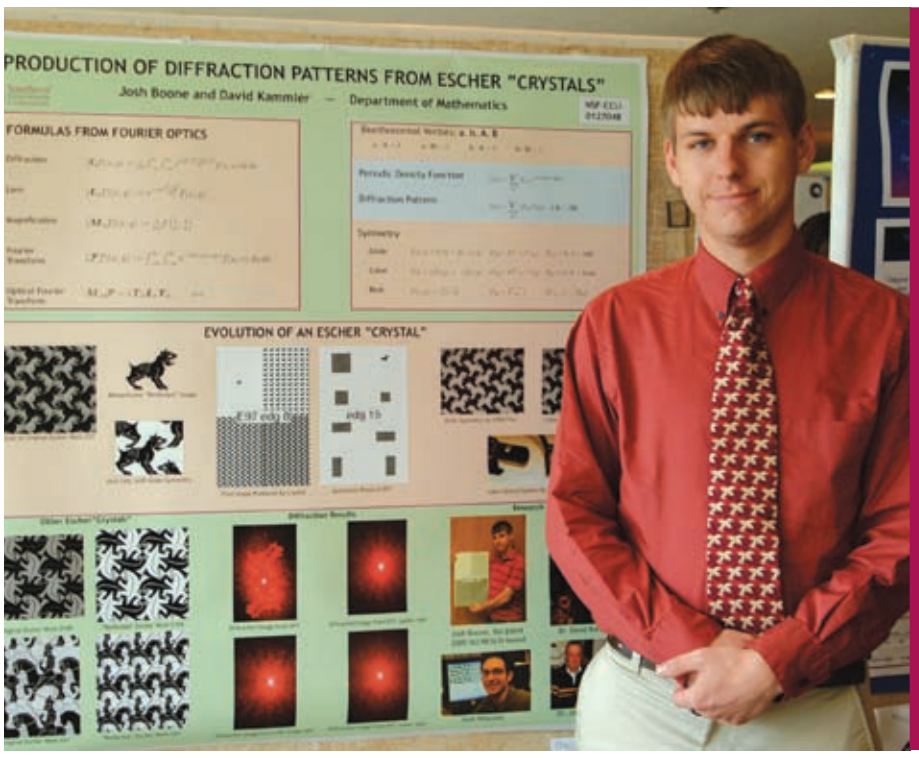
We believe students learn best from faculty who are creating new knowledge and advancing their disciplines through research. Historically, many of our undergraduate student workers have had the opportunity to work alongside faculty on research projects. That experience will serve them well in their careers or graduate school. Over the past few years, however, two programs have greatly expanded research opportunities for undergraduates on campus.

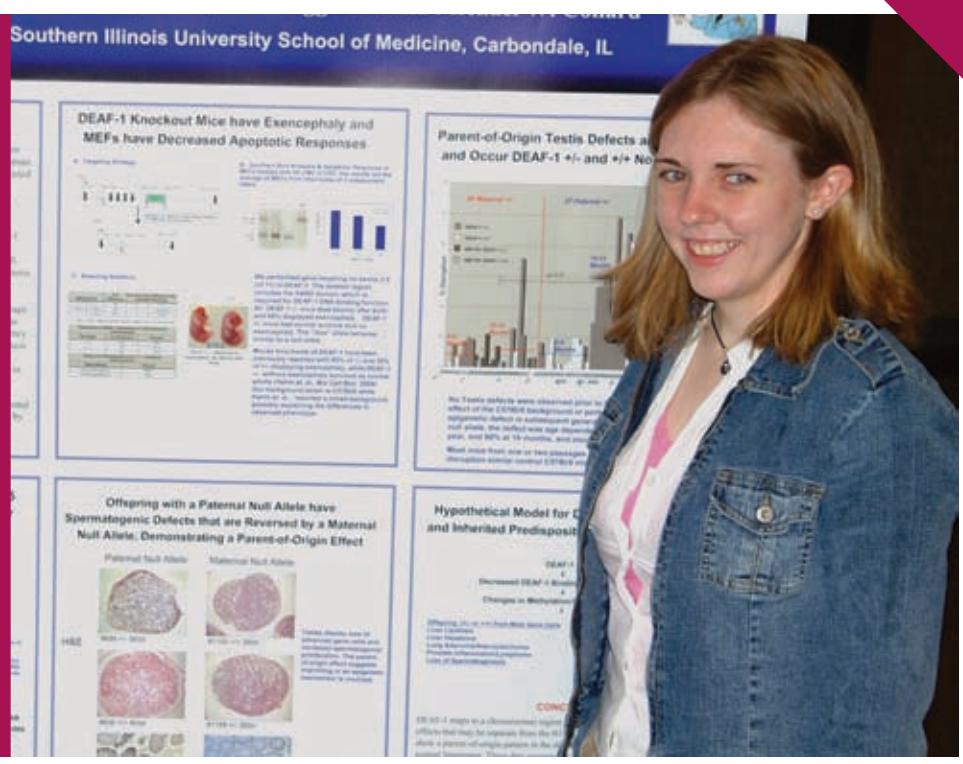
First is the **Undergraduate Assistantship Program.** Although not specifically a research program, many assistantships involve doing research with faculty mentors. See the sidebar at left for information.

The second program, the core of the undergraduate research effort at SIUC, is **REACH (Research-Enriched Academic Challenge).** REACH seeks to enhance the undergraduate experience by promoting, coordinating, publicizing, and helping to fund undergraduate research on campus. See the sidebar above for information about our research grants to students and our annual Undergraduate Research Forum. To achieve its aims, REACH is working closely with the SIUC faculty, University Honors Program, and McNair Scholars Program.

We hope you enjoy reading about the sampling of undergraduate research successes in these pages. If you're a current student, see what some of your peers are doing and consider getting involved in undergraduate research yourself. If you're a prospective student or a parent, this newsletter and our web site, **www.siu.edu/~reach,** will help acquaint you with the research opportunities available at SIUC. If you're a faculty member, we encourage you to become an active research mentor for undergraduates, if you aren't already. To explore the possibilities, contact me at **reach@siu.edu.**

—Jo Nast, Director, REACH





Clockwise from above: Joshua Boone and Sara Reardon, co-winners of first place; Andrew Blackwell and Cassandra Rogers enjoy the event; students browse each other's work; Frederick McLevich III, whose poster took second place; judging of entries. ***Photos by Cheryl Broadie, IMAGE.***

Boone, Reardon co-winners of 2006 Undergraduate Research Forum

Forty-five students from the sciences, social sciences, arts, and humanities—a total of 18 programs in all—presented posters at the 2006 Undergraduate Research Forum on April 3.

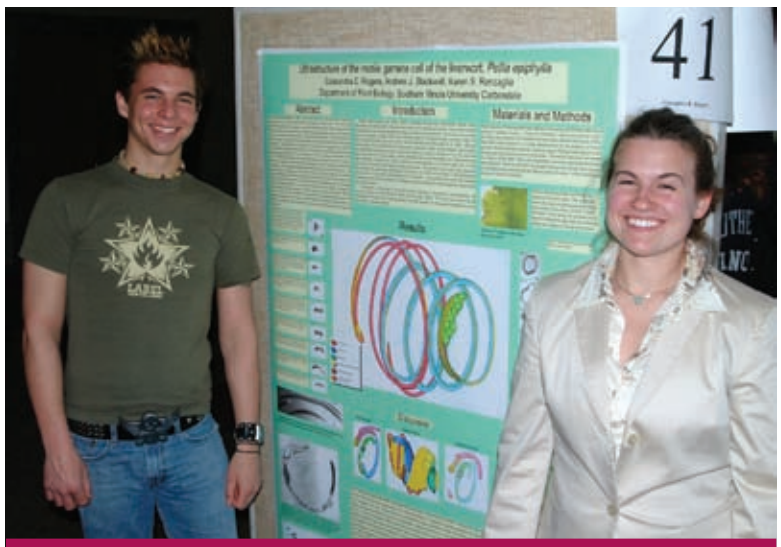
First-place winners were **Joshua Boone,** a mathematics major, and **Sara Reardon,** a microbiology major. Boone used drawings by M. C. Escher to illustrate the mathematical ideas of crystallography and light diffraction patterns. Reardon, who went on to take second place at the St. Louis Area Research Symposium (see page 1), studied the defects resulting in the offspring of mice with structural changes in a particular DNA transcription factor; the research relates to cancer development. Boone's mentor was math professor David Kammler; Reardon's was physiology professor Michael Collard.

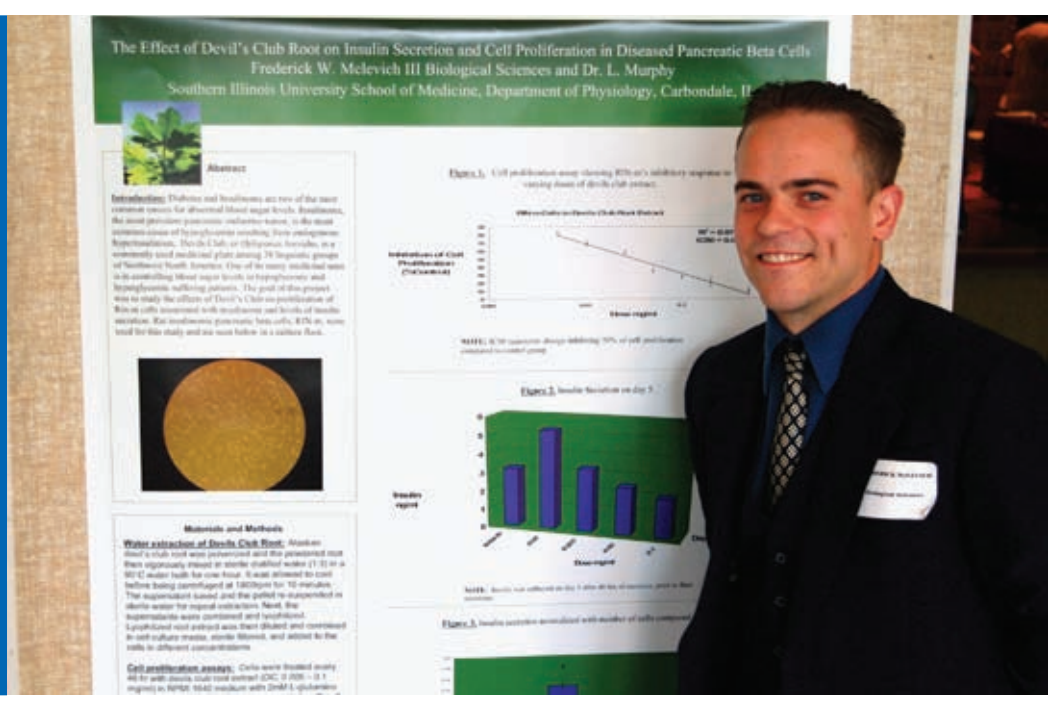
Second place went to **Frederick McLevich III,** physiology, who studied the effect of a substance called devil's club root on the proliferation of cells associated with insulin secretion. The long-term interest is whether derivatives of this plant could help control blood sugar levels. McLevich's mentor was physiology professor Laura Murphy.

Laura Gibson, chemistry, and **Matthew Wegener,** zoology, tied for third place. Gibson is working with chemistry professor Bakul Dave on the possibility of developing a new biologically friendly material for sustained drug delivery (see article page 4). Wegener did research with a team studying an invasive fish, the Asian carp, in the Illinois River; his mentor was zoology professor James Garvey.

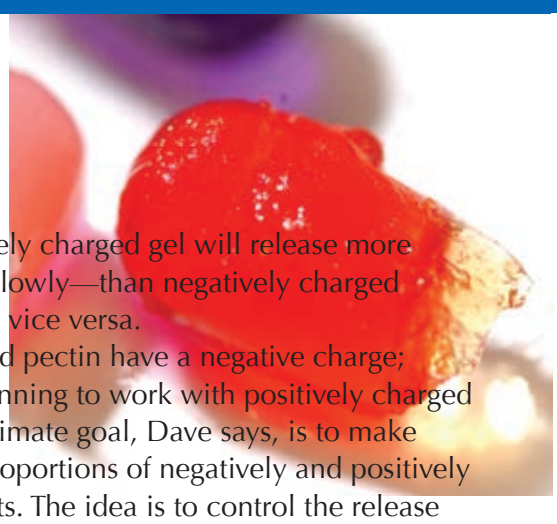
LaQuita Smith, industrial engineering technology, took honorable mention for her research with a team working to develop a fail-safe child car seat (see article page 5). Her mentor was civil engineering professor Max Yen, director of the Materials Technology Center.

Finally, **Jonathan Cohen,** forestry, captured the People's Choice Award with his research on people's attitudes toward forest management practices in Southern Illinois. His mentor was forestry professor Jean Mangun.





TAILORING THE MATRIX FOR DRUG DELIVERY



Laura Gibson's research samples are as brightly colored as jewels—and it's just possible they may have a bright future in health care.

"This is a polysaccharide gel I made yesterday," says Gibson, a chemistry major, as she eases a translucent red pellet out of a makeshift vial. The pellet, about as big around as a crayon, feels something like Jell-O and something like hard-boiled egg white.

Laura Gibson and her mentor, Bakul Dave. Below and above right: Polysaccharide gels that Gibson is testing.

"Lab exercises in textbooks are very cut-and-dried, like a recipe. Research isn't like that. You have to figure out the path on your own."

Like Jell-O and egg white, this gel is edible, being made mostly of carrageenan (a seaweed derivative used in ice cream) and pectin (the substance that makes jelly gel). The gel is a carrier—a matrix. The red color comes from dye molecules entrapped within it like fruit in a Jell-O mold, as Gibson says. When the gel is placed in water, the dye molecules will slowly diffuse out of it.

Polysaccharides are carbohydrates—starches, sugars, cellulose. But Gibson's gels, despite their ingredients, have nothing to do with nutrition. She hopes they might someday be made into tiny implants for safe, slow-release delivery of drugs directly to diseased tissue.

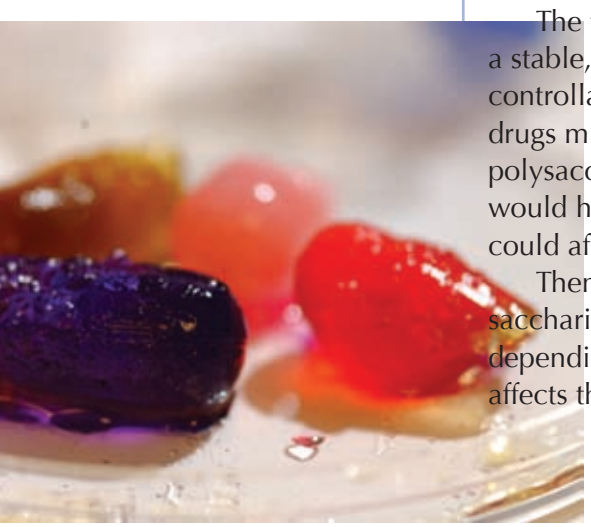
Polysaccharides will gel in the presence of certain types of salt solutions. For example, carrageenan gels when mixed with potassium chloride; pectin gels when mixed with calcium chloride. The reaction "creates a structure sort of like a double Slinky," says Gibson, "and you can put drug molecules inside."

As a sophomore, Gibson won an undergraduate assistantship to do research in the lab of chemistry professor Bakul Dave. A postdoctoral fellow in Dave's lab showed Gibson how to make a gel out of carrageenan and asked her to explore the possibilities of such gels for drug delivery.

Other research labs have studied the release of molecules from carrageenan. But Dave, who is a materials scientist, wants to go a step farther: tailoring polysaccharide gels to control the release rate of molecules. "Can we selectively tune it?" he says. If so, these gels might have great potential for medical uses.

Gibson ticks off some of the advantages that polysaccharide gels would offer for drug implants: they're nontoxic, inexpensive, and can be metabolized. They would dissolve harmlessly in the body rather than having to be removed after treatment.

As a proxy for drug molecules, Gibson is currently using dye molecules, since their release is easier to monitor. She also uses an instrument called a UV-visible spectrophotometer to determine the rate at which the dye molecules are released when the gel is placed in water.



The trick for medical applications will be to produce a stable, firm gel that can release drug molecules in a controllable way, preferably over days or weeks. Specific drugs might require the formulation of specific types of polysaccharide gels. For example, since drug molecules would have to fit into the gels' Slinky-like cages, their size could affect the choice of polysaccharide.

Then there's the matter of electrostatic charge. "Polysaccharides will react differently with different drugs depending on the charge of the drug," Gibson says. That affects the drug release rate. Positively charged molecules carried in a negatively charged gel will release more reluctantly—more slowly—than negatively charged molecules will, and vice versa.

Carrageenan and pectin have a negative charge; Gibson is now beginning to work with positively charged gels as well. The ultimate goal, Dave says, is to make gels with varying proportions of negatively and positively charged components. The idea is to control the release rate of a particular drug by controlling the overall charge of the gel.

Changing the acidity or alkalinity of the water also can change the release rate, so the gels will eventually need to be tested in fluids chemically similar to body fluids.

Dave and Gibson are most interested in the idea of using drug-laden gels to treat eye infections, particularly serious infections that can result in blindness.

Many eye infections, Gibson explains, require frequent treatment with eye drops, which "don't do their job very well." Very little of the drug—"maybe only 5 percent," she says—reaches the infected cells that are its target. And in the case of deep-tissue infections, eye drops don't penetrate deeply enough, meaning that drugs must be administered by injection.

If researchers can make the gels in the form of tiny implantable beads that would release the needed drug slowly, over the course of a week or a month, serious infections could be treated with less pain and fewer doctor visits for the patient. The gel implant might be delivered via a needle, with the advantage that fewer injections would be needed. Or, less invasively, it might simply be tucked into the corner of the eye, where it could float in tear duct fluid and release the drug over a period of time.

Gibson hopes to continue working on this project for the rest of her undergraduate career. "It's been a good first experience with research, and I think it's an experience that probably most people don't have until their second semester of grad school," she says of her assistantship.

"Lab exercises in textbooks are very cut-and-dried, like a recipe. Research isn't like that. You have to figure out the path on your own. And it might be the wrong path—you may make mistakes—but you learn something from it, and that's what's important."

Gibson's father is a civil engineer, and she grew up watching "Bill Nye the Science Guy" and "Newton's Apple." She "always loved science," she says, and found her niche with a chemistry class in high school.

"[Chemistry] gives me a greater appreciation for the world around me," she says. "The universe is so complicated, when you start looking at little pieces of it, but it's so elegant—it works so well together."

Gibson has a little bit of theater in her blood too. "Talking plus chemistry equals a good time for me," she admits. As a result, she has done several science lab demonstrations for television news broadcasts on KFVS-12 in Cape Girardeau, Mo. "I'm kind of a regular over there now," she says.

Her aim is to get her doctorate in chemistry and perhaps become a professor, but she wouldn't altogether mind being the next generation's Bill Nye. "Especially for girls," she says. "You don't see a lot of women in science.

"Maybe some girl will be watching channel 12 and say, that Laura Gibson is in science and she's having a good time, and that's cool. Who knows?"

—Marilyn Davis, ed.

Laura Gibson's poster presentation about her work with polysaccharide gels tied for third place in the 2006 Undergraduate Research Forum.

"My interest in archaeology began with a course in the spring semester of my sophomore year, followed by a summer archaeological field school in the tiny little town of White Cloud in northeastern Kansas. During that summer, many decades ago, the people and the activities contributed to a wonderfully enriching experience and I discovered how I wanted to spend the rest of my life."

—Prudence M. Rice
Distinguished Professor of Anthropology
Associate Vice Chancellor for Research and Director, ORDA

Working to make infant car seats safer

Adapt an infant car seat to make its use fail-safe.

That was the research challenge thrown at SIUC industrial engineering technology student LaQuita Smith and University of Missouri–Columbia mechanical engineering student Matthew Pais last summer, when both were attending a special Research Experiences for Undergraduates program at the University of Missouri–Rolla.

The National Highway Traffic Safety Board has reported that as many as 80 percent of infant car seats are used improperly, leading to many cases where infants die in auto accidents that they could have survived.

With marching orders in hand, Smith and Pais set to work. They not only wanted a self-diagnosing car seat, says Smith, but they wanted it to be "user-friendly."

A properly used car seat must meet several criteria. It must be installed in a back seat, not a front seat. It must be facing the correct way (to the rear if the child is below 22 pounds; to the front otherwise). It must be fastened securely with seat belts. The child must be within the given weight and height restrictions for the seat. And finally, the child must be buckled in properly.

Smith and Pais added buttons to the car seat buckles so that the buckles could not be partway engaged by mistake. They added a thin, flexible panel to the seat that could detect the child's weight, and they used an infrared sensor at the top of the seat to detect height violations (a child's head should extend no more than 1 inch above the seat). Finally, they added sensors that could detect if the car seat was installed in the front seat or facing the wrong direction for the weight of the child.

Smith and Pais then wired these sensors up to error lights that they installed across the top rim of the seat. The lights would give parents a visual warning if anything were amiss and would be labeled to tell them exactly what the problem was.

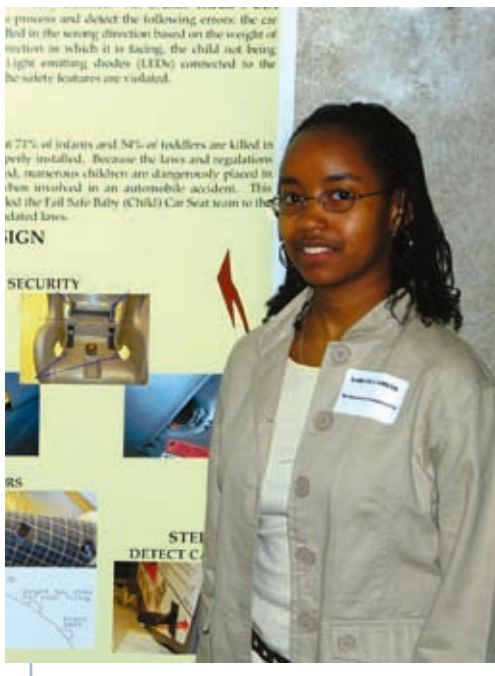
Smith wrote the microprocessor codes for the sensors and worked with component evaluation and machining. She also wrote codes into the system to allow for the eventual addition of audible, not just visual, alarms.

Now it's up to the University of Missouri–Rolla to pursue commercialization.

"It wouldn't cost users that much more than car seats do now, and lives could be saved," Smith says of the final product. The modifications cost the team less than $45 at retail outlets, and manufacturers' costs for those components should be much less, she notes.

—Marilyn Davis, ed.

LaQuita Smith was a McNair Scholar (see page 6) in 2005-06; her mentor was civil engineering professor Max Yen, director of SIUC's Materials Technology Center.



LaQuita Smith displays the results of her car-seat safety project at the 2006 Undergraduate Research Forum, where she took honorable mention.

Inventing a better injector kit for diabetics

When his older brother found him that morning, Tim Ditch was already shaking, incoherent, and on the verge of slipping into a diabetic coma.

Andy Ditch knew he needed to raise his brother's blood sugar level, and fast. The quickest way to do that was to inject him with a syringe containing glucagon. But after finding Tim's emergency injection kit, Andy's heart sank as he unfurled the 2-foot-long, small-print instructions for loading, dissolving, drawing, and finally injecting the critical substance.

Andy did fine, but his dilemma inspired his brother's senior thesis research project in interior design. For that work, overseen by design professor Steve Belletire, Tim Ditch created a device that could speed up and simplify emergency glucagon injections for diabetics.

As someone with Type I diabetes, Ditch always carries an injector kit. (The morning his brother saved him, he had overexerted himself on an overnight field trip.) To start his project, he did extensive research on existing injector kits, including those used for other emergency situations, such as spring-loaded epinephrine syringes for treating severe allergic reactions.

He also interviewed diabetics, health care providers, and emergency medical technicians about how to improve the injectors. The themes that emerged didn't surprise him: users wanted simplicity, comfort, cost-effectiveness, and confidence in how to work the device under pressure. Many of them also preferred keeping the needle out of sight so it wouldn't be distracting.

After listing all the potential problems with existing products, Ditch began working on a prototype, trying one idea after another and seeking additional input from those who would use such a device.

The design he settled upon resembles a joystick handgrip that requires just two simple movements.

First, you push a plunger to break and mix a preloaded vial of glucagon with a dissolving agent. Then you place the device against a body part with lots of tissue, such as the thigh, and push. A housing covering the needle at the end of the handgrip slides back as it is pushed down, allowing the needle to travel into the muscle and deliver the glucagon.

"It's designed to be used by the diabetic or by anyone else nearby if the person is past the point where he can help himself," Ditch said. "The difference in time can be the difference between recovering and…not recovering."

To keep costs down, Ditch designed the device to be reusable by changing the needle and reloading the injector with a new glucagon vial.

Ditch, who earned his degree in December 2005, planned to enter the product design field after graduation.

"I like working with form, color, concepts, and problem-solving," he said. "You can apply all that to how and why people interact with a product the way they do."

—Tim Crosby, SIUC Media & Communication Resources

Tim Ditch with some of his designs for a simplified emergency glucagon injector.

Exploring an urban extreme by day and by night

Art student Esteban del Valle carried out his most recent creative project far from Carbondale, in the heart of Times Square, Manhattan.

A painter and multimedia artist who focuses on the urban landscape, del Valle had strong memories of the visual impact of Times Square from a visit a couple of years ago. For a summer research project as part of SIUC's McNair Scholars program (see box below), he revisited Times Square for nine days in June 2006, exploring the aesthetic and psychological differences between the area's daytime aspect and its nighttime one.

He took as his inspiration the way that Impressionist painters captured the changing moods of a landscape as the light varied. But what he ended up with on paper and on canvas was quite different, stylistically, from Impressionism.

Del Valle spent several hours a day in Times Square, taking photographs, making sketches and paintings, and recording his impressions in a diary. Back in his studio in Carbondale, he used these raw materials to make a series of artworks depicting Times Square by day and by night. Because his chief goal was to represent the effect of this place on the observer, most of his paintings include himself, either as part of the crowd or as the main subject.

Because the artificial lights of Times Square are muted by sunlight, del Valle decided to use watercolor as his medium for the daytime paintings. These paintings, which are almost delicate, "are more about representation of the environment," says del Valle.

The nighttime images are completely different. These, says del Valle, "are more about the feeling of being in Times Square. I used multimedia to create the idea of overstimulus."

These paintings, which are mostly self-portraits, use collage, oils, acrylics, spray paint, and other materials to represent the visual bombardment of artificial light and human activity in Times Square by night. Del Valle drew the outlines of his face in charcoal or shoe polish, then filled in the spaces with lots of bright color to create a "neon glow." The paintings also incorporate bits of paper, such as ticket stubs and museum maps, that he found in New York City.

Because these paintings were about his own state of mind in the midst of this bustling, jarring, garish urban space, he says, "the background became less critical."

"Self-Portrait in Times Square," by Esteban del Valle. 2006. Mixed media. 20 x 20 inches. *Used by permission of the artist.*

The paintings are vibrant but also a little nightmarish.

Del Valle's mentor, assistant professor of art Najjar Abdul-Musawwir, was the one who originally pushed him to explore mixed media. Del Valle now feels that multimedia work is critical to the future of art. "If we desire to express contemporary ideas, we must use contemporary tools," he said when presenting his project at the McNair Research Symposium this past summer.

With a REACH Award for 2006-07, del Valle plans to carry out a series of mixed-media portraits exploring his coming of age in Chicago and his relationships with close friends there.

His work is thoroughly urban. "I'm very interested in the effects of a city on artists," he says.

During the hours he spent in Times Square obsessively taking photographs and making sketches, few people stopped to ask him about what he was doing, he says—"but those who did turned out to be artists themselves."

—Marilyn Davis, ed.

Esteban del Valle took first place in the 2006 McNair Scholars Research Symposium.

"The nighttime images are more about the feeling of being in Times Square. I used multimedia to create the idea of overstimulus."

Esteban del Valle is intrigued by the effects of the urban environment on artists. *Photo by Gina Rodriguez.*

SIUC's McNair Scholars Program gives underrepresented students research and academic skills

Undergrads who are first-generation-college/low-income students or minority students may want to check out the Ronald E. McNair Postbaccalaureate Achievement Program, popularly known as the SIUC McNair Scholars Program. This federally funded program prepares undergraduates to succeed in doctoral study by giving them mentoring, research experience, GRE preparation services, and more.

McNair Scholars' research projects have ranged from English student Lynn Vaughn's study of sensationalism in Edgar Allan Poe's writing (left) to chemistry student Maurice Betts's research on compounds for drug delivery (right). Students present their results at SIUC's Undergraduate Research Forum and at the annual summer McNair Research Symposium.

For information about this program, see **www.siu.edu/~mcnair.**

FROM PAGE 1 — ST. LOUIS SYMPOSIUM

that SIUC undergraduate students are receiving as a result of these programs."

More than 50 students from St. Louis University, SIUC, the Columbia and Rolla campuses of the University of Missouri, Washington University, and Webster University took part in the event, open to undergraduate researchers in science and engineering.

• Reardon, who held a REACH Award to conduct her research, bred mice lacking a gene that regulates a certain aspect of the overall structure of chromosomal DNA. Ensuing defects in the offspring of those mice included sperm loss and tumors. She found that sperm loss occurred in male offspring when the fathers lacked the gene but not when the mothers lacked the gene.

Her results indicate that specific DNA structures are established differently in the eggs and sperm of the parents, and that changes in the structure can predispose offspring to infertility and cancer.

• Many low-power communications and sensor-network applications are in the S-band part of the radio spectrum given to industrial, scientific, and medical uses. Antennas for this band must be wide- or multi-band but also small, with a steerable directional beam.

Ouedraogo's research introduced a novel, very small type of antenna with a very wide bandwidth. He integrated this antenna into a specific type of active phased array antenna. The small size of the new antenna's elements, as well as the high efficiency and broadband characteristics of the array antenna, make the set-up an excellent candidate for several S-band applications that require huge volumes of high-speed data transfer among mobile users.

Electrical engineering professor Frances Harackiewicz served as Ouedraogo's mentor.

• Jones and his colleagues recorded the activity of nerve cells in brain slices to look at the relationship between glucose levels outside the cells and their capacity to communicate synaptically. This process underlies central nervous system function and requires a lot of energy, which glucose supplies. He also looked at the effects of aging on the process.

His results revealed that older nerve cells don't use glucose as well. That could partly explain why learning, memory, and other cortical functions decline as people age. The finding also suggests directions for developing new treatment strategies aimed at reducing this kind of decline.

Jones's work was supported by a REACH Award. His faculty mentor was physiology professor Peter Patrylo.

—K. C. Jaehnig, SIUC Media & Communication Resources

"From many perspectives, research is the highest form of teaching and learning, where the student and faculty member experiment, problem-solve, and learn together."

Interested in participating in StLAURS 2007?

Students from SIUC may present a poster, give an oral presentation, or simply attend the 2007 St. Louis Area Undergraduate Research Symposium (see article above). Place and date were yet to be announced when this publication went to press.

The deadline for submitting an application to give an oral presentation or present a poster will probably be in February or March 2007. Prizes will be given for top presentations and posters.

When more information is available, it will be posted on the StLAURS website, **www.stlaurs.com.** Interested students also may contact Jo Nast, director of REACH (SIUC's undergraduate research program), at reach@siu.edu.

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exposed to different disciplines so they will understand how each field thinks and communicates."

Max Yen, director of the Materials Technology Center at SIUC, says the students are working on nanotechnology projects in the center's labs and elsewhere around campus. Nanotechnology, which involves the study and design of materials at the molecular level and the creation of super-small devices and structures, provides an ideal arena for students to work across disciplines, he says.

"With nanotechnology, you have to be knowledgeable in many fields. Everyone involved has their own niche, but to make the student successful they will need good knowledge of fundamental science—the total package. We need people who are willing and wanting to put it all together."

For the past decade, the University has played host to a handful of students for a summer research program, Dyer says. The NSF grant allows for vast improvement, however, because of the increased funding and its reliability. Those aspects mean the University can better recruit top undergraduate students to the program, which ultimately might bring them to SIUC to pursue graduate degrees.

The first 10 students in the REU program, including one from SIUC, conducted their studies this past summer. The group, made up of sophomores and juniors from mainly Midwestern universities and colleges, included one student in engineering, three in physics, and six in chemistry.

Students worked with SIUC researchers from those three disciplines. The researchers focused their efforts on developing new materials, Dyer says, studying various properties and then isolating and controlling them.

"Any time you're talking about materials research, in the long term it's about creating some sort of device," Dyer says. Among those on the drawing board for the program are drug delivery and tissue engineering systems and sensors.

Landing the funding was no easy task. The NSF program is highly competitive, with many top science research departments in the country vying for the money each year. But now that SIUC is an REU site, says Dyer, the NSF is likely to renew the grant after three years.

—Tim Crosby, SIUC Media & Communication Resources

Callie Bradley, an REU student from Taylor University, and SIUC physics professor Samir Aouadi prepare to create a nanocomposite thin-film sample in a vacuum chamber.

AWARDS HELP HIGH ACHIEVERS PLAN GRADUATE STUDIES

Important Deadlines

Applications for **2007-08 REACH Awards** are due on **Friday, January 26, 2007.** Application materials and information about the program, including eligibility requirements, can be found at **www.siu.edu/~reach/awards.html.**

Letters of intent to participate in the **2007 Undergraduate Research Forum** are due on **Friday, February 2, 2007.** Information can be found at **www.siu.edu/~reach/forum.html.** The 2007 forum will be held on **Monday, March 26.**

Questions about the awards and the forum may be directed to Jo Nast, REACH Director, at reach@siu.edu or 453-4532.

Applications for SIUC's **McNair Scholars Program** are usually due in March. This undergraduate program, which has a substantial research component, prepares students for graduate study.

For information and eligibility requirements, see **www.siu.edu/~mcnair.** Questions may be directed to Julia Spears, Program Coordinator, at mcnair@siu.edu.

Two SIUC students are among just 323 nationwide who will receive 2006 scholarships from the Barry M. Goldwater Scholarship and Excellence in Education Foundation.

Kathleen Lask, a sophomore in physics and mathematics, and **Austin Mohr,** a junior in mathematics and computer science, are among only 11 students in Illinois to receive the honor. Each will receive $7,500 for the 2006-07 school year.

Lask plans to pursue a doctorate in chemical physics and continue her work in experimental physics. Ultimately, she wants to research alternative energy sources and conservation methods.

Mohr is pursuing a career as an educator with an ultimate goal of teaching at the university level.

Lask and Mohr bring the number of SIUC students to win the prestigious award up to three.

Laurie Bell, assistant director of SIUC's University Honors Program, says the office identified both Lask and Mohr during their freshman year as potential high achievers in scholarship. Bell worked with the students' faculty to prepare them to compete for top-level honors such as the Goldwater award.

The Goldwater Foundation is a federally endowed program that assists outstanding students in mathematics, natural sciences, and engineering. Scholars are selected on the basis of academic merit. This year the field included 1,081 applicants.

Goldwater Scholars Kathleen Lask and Austin Mohr (center) with Provost John Dunn (left) and Chancellor Walter Wendler.

Fahran Robb, a senior in agricultural information and political science, was one of just 60 college students nationwide named to the 2006 All-USA College Academic Team by *USA Today.*

The newspaper selected Robb from a pool of more than 600 nominees. Robb, who also is pursuing minors in speech communication, environmental studies, and agribusiness economics, is the first SIUC student to receive the honor in the program's 17-year history.

The program honors full-time undergraduates who excel in scholarship and extend their abilities beyond the classroom to benefit society. Judges rate applicants based on grades, academic rigor, leadership, activities, and an essay describing their most outstanding intellectual endeavor.

The 21-year-old has specific interests in alternative fuels, such as ethanol, and preserving natural resources. In 2005 she wrote a white paper for the National Corn Growers Association on biomass conversion to ethanol.

She plans to pursue graduate studies at either Cornell University or Yale University, aiming for joint degrees in agribusiness economics and law.

Fahran Robb, the first SIUC student named to the All-USA College Academic Team.

Leah Holmes, a first-year master's student in animal science, food and nutrition, took first place for research that she did as an undergraduate in a competition sponsored by the American Dairy Science Association and the American Society of Animal Science.

Holmes's research, conducted in 2005 with SIUC assistant professor Amer AbuGhazaleh, focused on the effects of supplementing the diets of grazing dairy cows with fish oil and sunflower oil in an attempt to boost the production of healthful fatty acids in their milk. She found the supplements worked, with no negative side effects.

Holmes received her $300 prize in March 2006.

REACH is funded by the Office of the Provost and the Office of Research Development and Administration.

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Provost & Vice Chancellor: John M. Dunn

Vice Chancellor for Research & Graduate Dean: John A. Koropchak

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Published by the Office of Research Development and Administration at Southern Illinois University Carbondale. For copies, call 618-453-4540.
Editor: Marilyn Davis, ORDA. Photos by SIUC Media & Communication Resources unless otherwise noted. Printing by SIUC Printing/Duplicating Service.